

afterwards shown to be appreciably in error, was of considerable importance historically, since it directed attention to the necessity of examining further the result obtained in 1863 and 1864 by Maxwell and his coadjutors for the British Association Committee on Electrical Standards.

In 1871 Kohlrausch introduced a method for measuring the electrical resistance of electrolytes founded upon the employment of alternating currents generated by the revolution of a magnet inside a coil of wire, the relative positions of magnet and coil being like those in an ordinary galvanometer. In this way the disturbing effect due to the polarisation of the electrodes was in a great measure, if not entirely, got rid of, and the results obtained were a great advance in respect of accuracy upon those previously obtained. In later modifications of the method the alternate currents of an induction-coil were used. This investigation formed the starting point of a long series of researches into the conducting power of electrolytic solutions. The examination of a great number of soluble salts in aqueous solutions of different concentrations showed that, although the conductivity decreases with decreasing concentration, the ratio of conductivity to concentration increases, at first nearly uniformly, but approaches a definite limit for each salt when very small concentrations are reached, that is, when the solutions are very dilute. It was further found that, when the proportion of salt in solution was expressed in terms of the equivalent mass of the salt, the limiting (maximum) value of the above ratio varied within comparatively narrow limits for a great number of salts. Another important result of Kohlrausch's experiments was the establishment of a simple relation between the conductivities of dilute solutions and the mobilities, as deduced from Hittorf's measurements, of the ions into which the respective salts may be supposed to be broken up when dissolved.

Kohlrausch rendered an extremely valuable service to the teaching of experimental physics by the publication, in 1870, of his "*Leitfaden der praktischen Physik*." This was the first, and, in the writer's opinion, the best of numerous works of the same kind that have since appeared in various countries, designed to guide students of physics in a systematic course of practical work in the physical laboratory. The high appreciation it has met with is shown by the number of editions that have been called for—it reached the eighth in 1896; it was translated into English by Messrs. T. H. Waller and H. R. Procter soon after its first appearance, and a second English edition was published in 1883.

G. C. F.

SIR CHARLES TODD, K.C.M.G., F.R.S.

FEW men have lived a fuller life or given more freely of their best than Sir Charles Todd, whose death we deeply regret to record. It is only about three years ago that he retired from active service, but he was then above eighty years of age and his career had been unusually long. His scientific life dates back to 1841, when he entered the Royal Observatory, Greenwich. The instruments, as those who used them, have passed away, and he must have been the last survivor of the little band who worked with the old meridian transit and circle. There he acquired a training in scientific methods which he was destined to turn to such useful account in promoting the interests of a new colony. In South Australia he found his work, and there his memory will be treasured. For it was his fortune to organise two départements, the Post Office and the Meteorological Service, which have contributed in no small degree to the growth of that thriving settlement.

It is not given to many to see their exertions and

plans so speedily and completely successful as did Sir Charles Todd, or to fill simultaneously the three important positions of Postmaster-General, Superintendent of Telegraphs, and Government Astronomer. But it will be admitted that he filled this trinity of offices with credit to himself and to the advantage of others. The Post Office was practically his own organisation, which, continually growing with the requirements of the Colony, proved itself equal to the increasing demands. It was in connection with the establishment of the Telegraph Service, and its growing needs, that he made that remarkable ride of 2000 miles across the arid interior of the continent of Australia, from Adelaide to Port Darwin. The energy and intrepidity of the man were well illustrated by this memorable venture. No wonder that he loved to tell of that day, when he sat on the ground near Mount Stewart, amid uncomfortable surroundings, but forgot all in the sense of successful achievement, when, with a little pocket relay, he connected the wires and held communication with the extreme north and south of the island.

As Government Astronomer, it will be remembered that Sir Charles Todd took part in organising the expeditions for the observation of the transit of Venus, that he kept the 8-inch refractor steadily at work, and did what lay in his power to maintain an interest in astronomy. Still greater was the service he rendered in promoting a meteorological and climatological survey—so necessary in a new country, where the climatic conditions are of vital importance to the incoming settler. For something like forty years he maintained the meteorological service, and has left to his successor a complete and well-equipped organisation.

His talents were admirably fitted for the field in which they found scope. He knew how to inspire others with the tireless energy that carried him through so many difficulties; his geniality secured him many friends and willing workers that enabled him to accomplish so much; his life and history are written in the progress of the colony during the last fifty years. Amid the regrets of those among whom he laboured so well and so long, he will be remembered as one whose services gained the approval of his sovereign and the cordial appreciation of his scientific colleagues, and especially as a typical specimen of that class which, great in resolve as in achievement, has given strength and impulse to our Colonial Empire.

NOTES.

At the meeting of the Paris Academy of Sciences on January 24 Lord Rayleigh was elected a foreign associate member in succession to the late Prof. Simon Newcomb. Lord Rayleigh was elected a correspondant of the academy in 1890.

M. EMMANUEL DE MARGERIE has been elected president for 1910 of the Paris Geographical Society, and M. H. Deslandres and Colonel Bourgeois vice-presidents.

DURING his recent visit to St. Petersburg, Sir Ernest Shackleton was presented with the Constantine gold medal of the Russian Geographical Society.

THE Lettsomian lectures on "The Cerebellum and its Affections" will be delivered by Dr. J. S. Risien Russell at the Medical Society of London on February 7 and 21 and March 7.

At the close of a public lecture by Dr. Sven Hedin in Rome on January 30, the King of Italy handed to him the large gold medal which has been conferred upon him by the Italian Geographical Society.

PROF. J. ARTHUR THOMSON has been elected president of the Royal Microscopical Society for the ensuing year.

WE regret to see the announcement of the death, on January 28, at seventy years of age, of Prof. F. Purser, professor of natural philosophy in the University of Dublin and the author of several notable works on Bessel's functions.

THE following officers have been elected for 1910 by the French Physical Society:—*President*, M. L. E. Bertin; *vice-president*, M. Lucien Poincaré; *general secretary*, M. H. Abraham; and *assistant secretary*, M. Jean Becquerel.

THE *Times* states that the Belgian expedition which will leave shortly for the Congo to make investigations in connection with sleeping sickness will be in charge of Dr. Rhodain, professor of bacteriology at the University of Louvain. Work will be begun in the northern part of the Katanga district.

THE president of the Royal College of Physicians has appointed Dr. H. B. Donkin to be the next Harveian orator, and Dr. G. N. Pitt to deliver the Bradshaw lecture. The Milroy lectures are to be delivered by Mr. A. G. R. Foulerton, on February 17, 22, and 24; the Goulstonian lectures by Dr. J. S. Bolton, on March 1, 3, and 8; and the Lumleian lectures by Prof. W. Osler, F.R.S., on March 10, 15, and 17.

WITH the object of giving still greater publicity to the advantages of intensive cultivation an exhibition of "French Gardening" is to be held at the Royal Botanical Society's Gardens at Regent's Park. Active preparations are now in progress for exhibiting and demonstrating every aspect of the close and scientific cultivation of the soil. The exhibition will take place in July, though the exact date is not yet definitely settled.

WE learn from the *Revue générale des Sciences* of January 15 that the French Guild of Jewellers is desirous of having the artificial "rubies" branded as *imitations*, like paste copies. Dr. Olivier, the editor of our contemporary, protests strongly against such action being taken by the Minister of Commerce, seeing that in composition and properties the natural and artificial materials are identical.

THE death is announced of Dr. J. Volhard, professor of chemistry in the University of Halle, at seventy-five years of age. For several years Dr. Volhard acted as Liebig's assistant, and ultimately was entrusted by him with the delivery of the course of lectures on organic chemistry which he regularly gave during the summer semester. His biography of Liebig, published last year, is a valuable and complete record of the life and work of that great chemist.

ON Tuesday next, February 8, Prof. F. W. Mott will begin a course of six lectures at the Royal Institution on "The Emotions and their Expression," and on Saturday, February 12, Sir J. J. Thomson will commence a course of six lectures on "Electric Waves and the Electromagnetic Theory of Light." The Friday evening discourse on February 11 will be delivered by Mr. C. E. S. Phillips, on "Electrical and other Properties of Sand," and on February 18 by Prof. H. H. Turner, on "Halley's Comet."

WE have received a letter signed by Lieut.-Colonel H. W. L. Hime, Sir G. Greenhill, and Mr. Oscar Guttman, pointing out that at present there is no memorial of the foremost man of science of the thirteenth century,

Roger Bacon, who foreshadowed many of the discoveries of modern science, and is known universally as the inventor of gunpowder. Contributions (however small) towards the erection of a memorial, in a suitable place, of this great Englishman may be sent to Mr. Oscar Guttman, 60 Mark Lane, E.C.

THE executive committee of the National Physical Laboratory, on the nomination of the advisory committee for the national experimental tank, has appointed Mr. G. S. Baker to the post of superintendent of the tank, the funds for which have been provided by the generosity of Mr. A. F. Yarrow. After a distinguished career at the Royal Naval College, Greenwich, Mr. Baker was in November, 1900, appointed an assistant constructor in the Royal Corps of Naval Constructors. He served four years as assistant to Mr. R. E. Froude, F.R.S., at the Admiralty Experiment Works, and two and a half years as professional secretary to the Director of Naval Construction, and has also had experience in the general design work of the Admiralty Office. Thus he goes to the laboratory with distinguished qualifications, and on the strong recommendation of those who have the best grounds for estimating the value of his previous work.

THE permanent committee of the International Congress of Photography is arranging to hold the fifth International Congress in Brussels early next August, or about that time. The primary object of these congresses is to reduce, as far as possible, the confusing and often inconvenient variations that occur in nomenclature, definitions, standards, &c. Promises of support have been received for the coming congress from all parts of the world, and arrangements are being made for the presentation of reports by specialists on recent progress and the present state of knowledge in many of the branches of photographic work. It is hoped that England will take a full share in the congress. A complete programme will be issued as soon as possible. The membership subscription is ten francs or eight shillings, which entitles the member to a copy of the report of the proceedings. Inquiries may be addressed to either of the honorary general secretaries, M. Ch. Puttemans, 1 Palais du Midi, Brussels, or M. L.-P. Clerc, 52 Boulevard Saint Jacques, Paris XIV.; but for the convenience of English members inquiries and subscriptions may be sent to Mr. Chapman Jones, 11 Eaton Rise, Ealing, London, W.

BY the courtesy of the director of the Meteorological Office, the advisory committee for aeronautics is able to announce that a selection of current autographic records of wind velocity from the twenty-three anemograph stations in connection with the office, and other meteorological documents of interest to aeronauts, will be available for inspection at the Meteorological Office daily from 10 a.m. to 4 p.m. (Saturdays, 1 p.m.). The structure of wind and the changes to which it is liable are of great practical importance in aeronautical work. The association of changes in velocity with changes in direction, which are sometimes quite sudden, make aeronautical work especially difficult. There is sufficient information now available to indicate the conditions in which such changes may be expected. The anemographic records are selected to show good examples of the different kinds of wind structure recorded at the anemograph stations in these islands and to illustrate the changes that take place. The phenomena on any selected occasion can be compared with records from barographs or other self-recording instruments, or with the conditions indicated on the daily charts. The exhibits also include the summaries, which are not

published, of the wind tabulations for all the anemometers in connection with the office from 1906 to 1909 inclusive. There is, besides, a series of diagrams representing the variation of wind velocity with height for all the kite ascents reported to the office in 1908 and 1909. These diagrams show a remarkable approximation, on many occasions, to direct proportionality between height above sea-level and the wind velocity in the upper air, irrespective of the height of the station at which the observation is made, and suggest a working practical rule for computing the increase of wind aloft. Opportunity is also afforded for considering the computation of gradient wind which must form the basis of any satisfactory method of dealing with wind measurements.

THE Paris floods have fortunately passed their maximum height, and are now generally subsiding. The information to hand having a bearing on the direct cause of the flood is exceedingly meagre, and until the detailed report of the Service hydrométrique is available little can be said. The data collected by this service is very complete, and extends over a period of fifty years. A series of low barometric systems passed over the northern portion of the Mediterranean and the south of France after January 19, and these occasioned exceptionally heavy rains in the catchment basin of the river and its tributaries. In Paris the aggregate rainfall from January 17 to January 25 was 2.08 inches, but this is quite inadequate to occasion the tremendous rise of the Seine which occurred; on no day did the rainfall amount to 0.5 inch. The rains were heavier near the source of the river, and in parts of France and Switzerland the rainfall for the two days January 18-19 amounted to fully 3 inches. According to the *Bulletin International* of the Central Meteorological Office of France, a swelling of the Seine was forecasted for January 20, but so late as January 20 the flood was not expected to exceed about 13 feet on January 22, and on January 21 this estimate was increased to 16 feet for January 23. On this date the estimate was further increased to 22 feet for January 24, and on January 25 the estimate for the increase was to 25 feet on January 26. At 8 a.m. on this date the actual flood reached 24.6 feet at Pont d'Austerlitz, 24 feet at Pont de la Tournelle, and 27 feet at Pont Royal, whilst a further slight increase was anticipated. The flood is said to have attained its maximum height on January 27-28, when it is reported as having reached 30 feet at Pont Royal. This is apparently higher than any previous record, exceeding that of 1764.

It is with regret that we announce the death, in his sixtieth year, of Prof. W. Hillhouse, who held the chair of botany and vegetable physiology in Mason College and the University of Birmingham from 1882, when the chair was founded, until last year, when he was compelled by ill health to resign his appointment. Prof. Hillhouse was born at Bedford in 1850, and some of the earliest of his botanical work was in connection with the flora of his native county. He became a scholar of Trinity College, Cambridge, and afterwards a lecturer in that University. He was also keeper of the University herbarium. His life at Cambridge was marked by the birth of the *Cambridge Review*, of which he was one of the founders, and the editing of which he shared with Prof. Arnold and Vice-Principal Dale. He was widely known in the Birmingham district for his interest in educational matters, and in particular his efforts were directed to the establishment of a university extension movement in connection with Birmingham. He was a most energetic

worker as honorary director of the Edgbaston Botanical Gardens, and was chairman of the council of the Midland Reafforesting Association. He was for a number of years on the Leicestershire Education Committee, and on retiring in 1909 received a very warm tribute for the services he had rendered in promoting the higher education of the county. One of his latest works on behalf of the University was the direction of the preliminary laying out of the ornamental grounds surrounding the new buildings at Edgbaston. His death will be sincerely regretted by his colleagues and by many of his old students, by whom his genial and kindly personality was much appreciated.

THE Victoria Museum of Launceston, Tasmania, is setting an example to other institutions of a like nature in arranging for the preparation of a series of dissected skeletons of native birds preserved in formalin. Of one of these a descriptive account has been published in the shape of a pamphlet, by Mr. H. H. Scott, the curator, under the title of "A Memoir on the Wedge-tailed Eagle, *Uroaetus audax*; a Study in Avian Osteology."

ACCORDING to vol. ii. of the Journal of the Ipswich and District Field Club, the local excursions have been well attended during the past season, and have attracted a large amount of interest. Specially noteworthy is the discovery of a new Pleistocene bone-bed in a railway-cutting near the city. In connection with another "find" of mammalian remains may be noticed a repetition of the common error of giving *Cervus elephas* as the name of the red deer. The issue concludes with a reprint of a paper, by Dr. Bather, on crinoid remains from the Red Crag.

THE hairy-nosed wombat, *Phascolomys latifrons*, has hitherto been regarded as peculiar to South Australia. It appears, however, that in the Melbourne Museum are preserved four specimens of this species obtained from a lonely part of New South Wales in or near Denison country so long ago as the year 1884. Whether the species still survives there is unknown, but the donor of the specimens stated that it never occurred in any other part of the colony. These New South Wales hairy-nosed wombats are stated to differ from their relatives in the south in the characters of the nose, while the skull appeared to be shorter and rounder. If these differences are well established, the New South Wales form apparently indicates a distinct species.

In an article on the menageries of the ancients and the Middle Ages and their influence on modern zoology, published in the January number of *La Revue des Idées*, Mr. Gustave Loisel directs attention to the circumstance that in ancient times Indians, Persians, Chaldeans, and Assyrians appear to have completely tamed the larger felines, carrying out this taming process to a considerably greater extent than is accomplished in the case of the hunting-leopard by the natives of modern India. They tamed the lion, for instance, to such a degree that it could be led in a halter and employed in the chase of deer, wild bulls, boars, and asses. It is also considered that the Chinese were the first to domesticate house-cats, and likewise to train cormorants for fishing.

In an article on Miocene trees, published in the January number of the *American Naturalist*, Prof. T. D. A. Cockerell points out the remarkable resemblance between the fossil trees of the Florissant beds of Colorado and those of Eningen, in Baden. Out of six species selected from each locality, two are common to both sets of strata, while four are representative of each other. Nine other Florissant trees are quoted as being represented by allied

forms at the present day, although in no instance is there specific identity, and it is noteworthy that some of the Florissant generic types are now restricted to Asia. Regarding the Eningen beds as of Upper Miocene age, the author considers that the Florissant deposits should be assigned to the same epoch.

To the January number of the *Zoologist* Prof. McIntosh contributes an article on the red or precious coral, in which he traces the evolution of our knowledge of this product from ancient times. Red coral was well known to the Romans, and about the beginning of the Christian era was exported in such quantities to India that it was difficult to obtain in the countries where it was produced. After describing the nature of the organism, and then giving a sketch of the mode of fishing, Prof. McIntosh states that the great bulk of the coral is sold at Messina, Naples, Genoa, Leghorn, and Marseilles, while the product of the Algerian fishery goes to Pisa and Trapani. About 160 tons of coral are brought yearly into Italy, the articles made from which are valued at nearly 500,000*l.* The total annual value of rough coral has been estimated at 2,000,000*l.*, while after manufacture the value is stated to reach no less than 10,000,000*l.* The finest quality is of a delicate pinkish or flesh-like colour, uniform in tint throughout, and occurring in large pieces. Inferior samples are sold at 2*l.* per ounce, and small fragments, used for children's necklaces, at 5*s.* an ounce. Even worm-eaten coral has a value in the East, as the natives of certain districts believe that gods dwell in the holes.

DR. VICTOR WIDAKOWICH contributes an important memoir on the inversion of the germ-layers ("Entypie") in mammals to the *Zeitschrift für wissenschaftliche Zoologie* (vol. xciv., part ii.). The memoir is very beautifully illustrated, and the drawings of models of various stages in the early development of the rat should be extremely useful to students of this difficult subject.

In the *Zeitschrift für wissenschaftliche Zoologie* (vol. xciv., part i.), Prof. B. Bachmetjew makes a very ingenious application of biometrical methods to the solution of the difficult problem of parthenogenesis and sex-determination in bees. From an elaborate statistical study of the variation in the number of hooks on the front margins of the hind wings, he finds that the resulting curves show either one or two maxima of frequency. He maintains that fertilisation of the eggs determines two maxima and parthenogenesis one. Thus queens always show two maxima of frequency in each hind wing; they are produced from fertilised eggs. Drones produced by workers show only a single maximum; they are produced from unfertilised eggs. With regard to sex-determination in bees, he adopts the preformation theory of Schultze and Lenthossék, but with the addition that drones may develop from unfertilised "female" eggs, and that the fertilisation of "male" eggs does not prevent the development from them of drones. He finds that one-year-old queens produce drones from unfertilised eggs—this appears to be the normal method. Queens of two or three years produce drones partly from unfertilised and partly from fertilised eggs, because, with advancing age, the closing mechanism of the seminal reservoir no longer works properly, and some of the drone eggs get fertilised, as it were, accidentally. Queens of four years and older produce drones from unfertilised eggs only, because all the spermatozoa have been used up. Several polymorphic forms of drones occur in the same colony, the form depending upon whether they are produced from fertilised or unfertilised eggs. Workers are produced only from fertilised eggs.

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THE correct botanical nomenclature of the plants yielding commercial cottons has provided much subject for controversy. A recent paper communicated by Mr. F. Fletcher to the *Cairo Scientific Journal* (November, 1909) discusses the botany and origin of American upland cotton. Evidence is adduced for the opinion that this well-known plant does not show the characters indicated by Miller's type of the species *hirsutum*, but conforms to the description and drawing issued by Tenore for *Gossypium siamense*. The author states that *Gossypium religiosum* of Linnæus also refers to the upland plant, but gives reasons for disregarding this specific name in favour of the former.

THE twentieth number of Notes from the Royal Botanic Garden, Edinburgh, completing the fourth volume, contains several short papers on abnormal developments in plants. Mr. A. J. Gray records an irregular condition in the sporocarp of *Salvinia natans*, where megasporangia were discovered in a microsporangial fruit, and Miss B. Chandler describes cases of anomalous branching at the end of aerial roots of *Tibouchina moricandiana* consequent upon the arrest in growth of the apical meristem. There is also an article, contributed by Mr. F. Darwin, referring to John Hope, a professor of botany in Edinburgh in 1780, and directing attention to certain of his drawings which indicate a knowledge of the light sensibilities of plants much in advance of the published references on the subject.

AN important paper by Dr. M. Greshoff, collating a large number of phytochemical investigations carried out by him in Kew Gardens, is published in the tenth and final index number of the *Kew Bulletin* for 1909, where there also appears the announcement of the author's sudden death. Dr. Greshoff had previously studied the occurrence of alkaloids and hydrocyanic acid in plants, and instituted the investigations here described with the object of discovering new plants of medicinal value, and of testing the presence of chemical constituents as a character of systematic value. The majority of the notes refer to the occurrence of saponin or hydrocyanic acid. Among the plants yielding saponin reactions are several genera of the Leguminosæ, notably *Astragalus*, which provides some of the American poisonous loco-weeds, and *Acacia*, of which several species furnish fish poisons; also four genera of the Caprifoliaceæ, three of the Polemoniaceæ and *Phytolacca* are included. The cyanogenetic list contains, among others, several genera of the Compositæ, *Oxytropis*, *Drosera*, *Dionæa*, *Cystopteris*, and *Davallia*.

THE wine industry of South Africa is discussed in a recent number of the *Agricultural Journal of the Cape of Good Hope*. Vines were introduced by the Huguenots, and found congenial soil and climate; the industry has remained in some districts, but is practically stationary, only 6,000,000 gallons of wines and 1,500,000 gallons of brandy being produced. It is urged that these figures are capable of very material improvement. In 1874 Algerian production was no more than that of South Africa, but is now, as the result of careful development, more than 130,000,000 gallons. Cape Colony, it is urged, could produce the light wines of France and Germany and the heavier wines of Spain and Portugal, and there seems to be no insuperable difficulty in the way of creating a flourishing industry.

THE last series of excavations at the amphitheatre known as Maumbury Rings, near Dorchester, has been conducted under the supervision of Mr. St. George Gray, of Taunton Castle, who asks for further support in this undertaking. One remarkable discovery has been made, that of the

cavea or den in which the animals were housed in readiness for the performances. Here the débris was found to contain coins of the Emperors Constantine the Great and Hadrian, which indicate the approximate date at which games were conducted by the Romans in this amphitheatre.

DR. R. B. BEAN, of the Anatomical Laboratory, Manila, publishes an account of a new cephalograph, an instrument intended to reproduce the outlines of the human head and face, which he has recently invented. It is based on the cranial instruments of Prof. Rudolph Martin, and is an adaptation of the pantograph. He also issues a further instalment of his examination of the Filipino types in the town of Taytay, which corroborates the conclusion at which he had previously arrived, that the population of the archipelago may be resolved into three types—Iberian, Australoid, and Primitive.

A LENGTHY but interesting study of memorising various materials by a new method forms the subject of a monograph by Prof. E. A. McC. Gamble, separately published by the *Psychological Review*. In this method a series of colours, odours, or syllables (all three materials are used in different experiments), is repeatedly presented to the subject, who manipulates the members of the series after each presentation and attempts to arrange them in their original order. The repetitions of presentation of the series are continued until successful reconstruction of the order is attained. Miss Gamble terms this method the "reconstruction method," and compares the results with those given by previous methods of experiment in memory. She finds that a relatively small number of repetitions is required for successful reconstruction, even at the outset of the experiments and apart from the well-marked improvement-effects of subsequent practice. Compared with the "learning method," in the reconstruction method the increase of difficulty with increasing length of the series is remarkably small. Again, in contrast to the "learning method," in Miss Gamble's method there is no sharp limit to the length of the series which is reproducible in correct order after a single presentation, and the subject remembers fully as many sequences and rather more positions in longer as compared with shorter series.

THE Canadian Department of Mines has issued in advance, from its annual report on mineral production, the chapters by Mr. J. McLeish dealing with chromite and asbestos mining in 1907-8. Canada supplies almost the whole of the world's asbestos, and the Canadian output has increased steadily from 27,414 metric tons in 1902 to 60,372 metric tons, of a value of 190,980 dollars, in 1908. The chief mines are in the eastern townships of the Province of Quebec, especially around Thetford. The Canadian output of chromite in 1908 was 7225 short tons (6554 metric tons), a slight increase over that for the previous year, but less than the record in 1906 of 9033 short tons. New Caledonia remains by far the largest producer of chromite; Turkey is second, and Canada has fallen to the fourth place owing to the rapid development of chromite mining in Rhodesia.

DR. V. CONRAD has recently investigated the annual and diurnal variations in frequency of 2497 earthquakes which occurred in the Austrian Alps and neighbouring districts from 1897 to 1907 (*Mitt. der Erdbeben-Kom. der K. Akad. der Wissen. in Wien*, No. 36). The annual variation is well marked, with its maximum in March and minimum in June, the amplitude being 65 per cent. of the mean monthly number of earthquakes. The diurnal variation is also strongly pronounced, the maximum occurring at

2 a.m. and the minimum from 8 a.m. to 4 p.m. Treating the hourly numbers of shocks with the aid of harmonic analysis, the diurnal period is found to have a maximum at 0½ a.m., and an amplitude which is 87 per cent. of the average hourly number of shocks. In all probability this daily change in frequency is due to the varying conditions under which the earthquakes are observed.

THE U.S. *Monthly Weather Review* for May last (which we have recently received) contains part ii. of Prof. C. F. Marvin's article on "Methods and Apparatus for the Study of Evaporation" (see NATURE, November 25, 1909). In this part the author describes the various instruments devised for the experiments upon evaporation of water from lakes and reservoirs undertaken by the Weather Bureau. The different kinds of apparatus, which were designed more especially for evaporation from pans, are clearly illustrated and their use fully explained. Among them is a self-registering gauge invented by Prof. Marvin which records, side by side on the same sheet, rainfall, wind, and evaporation, and seems to meet in a satisfactory manner most of the conditions required of such an instrument; the traces are legible, and the apparatus is said to be portable and easily installed.

THE January number of the *Illuminating Engineer* of New York contains a well-illustrated article on the electric lighting of the White House, Washington, a dwelling which it characterises as "decidedly unpretentious and plain" in comparison with many mansions of to-day. The imitation candle supporting a miniature incandescent lamp is the unit on which the lighting system is based. In general, they are grouped and supported in an artistic manner, but in one conspicuous case the supports are much too massive.

THE United States Coast and Geodetic Survey has recently published an appendix to the report of 1908 which deals with the magnetic observations made on land and by the four vessels engaged in work at sea during the year ending June, 1908. The observations on land are made with a theodolite magnetometer and a dip circle, and those at sea by means of a Lloyd-Creak dip circle checked at intervals by comparison on land with a magnetometer. The whole of the instruments were previously standardised at the Cheltenham Observatory. The present results are summarised in twenty pages of tables. A comparison with previous results shows that the secular increase of westerly deviation on the Atlantic seaboard is about five minutes of arc per annum. Inland the change becomes very small, but rises again to about four minutes per annum increase in the easterly declination at the Pacific seaboard. It may be noted that these secular changes are not quite in agreement with the representation of them as due to a slow drift of the magnetic system of lines to the west.

UNDER the London Gas Act, 1905, the gas companies were relieved of any obligation to remove sulphur compounds (other than sulphuretted hydrogen), and to replace the standard Argand burner, London Argand No. 1, by another, the London Argand No. 2. The practical effect of this was to enable the gas supplied to be lower in illuminating value by from 1.5 to 2.0 candles. In addition to this, two of the companies were empowered to lower the minimum candle-power from 16 to 14 candles, and in the Gas Light and Coke Company's Act, 1909, the latter company is also permitted to supply 14 instead of 16-candle gas. The 1905 Act also empowered the controlling authority to make tests of the calorific power, and in the 1909 Act, which has just come into force, a statutory minimum net calorific power of 112.5 calories per cubic foot is enforced. As compared with the state of affairs

five years ago, the consumer of gas for power or heating purposes has now to burn about 1200 cubic feet of gas in the place of 1000, costing 3s. 2½d. as against 3s., plus a meter rental (varying with the consumption), plus the extra cost of repairs caused by the additional sulphur present. The consumer, for lighting purposes, if using throughout an incandescent mantle, is not seriously prejudiced; if, however, he retains the batwing burner, his outlay for the same amount of light has increased in the ratio of about 4/3, plus a meter rental and plus an increased cost of internal decoration due to the condensation on the walls and ceilings of an increased amount of sulphuric acid.

THE *Scientific American* for January 15 shows an illustration of the McClean-Lissack automatic rapid-fire gun, which was tested last year by the Ordnance Department of the United States Army. This gun is designed for attacking balloons, and is mounted on a Packard 3-ton automobile truck. The gun fired 3-lb. shots at the rate of 100 per minute, the range being 3½ miles. With brakes on, the truck did not move on firing, and no shock was perceived by those standing on the truck platform. With brakes released there was a slight movement on the recoil, but no shock. Further tests with this gun are being made at Sandy Hook and Springfield for the army, and at Indian Head for the navy. The same article also illustrates two German automobile guns designed for the same purpose. One of these is mounted on an armoured truck of 60 horsepower, capable of a speed of 45 kilometres per hour. The shell from this gun has a maximum height of trajectory of 3800 metres.

THE ninth report to the alloys research committee was presented by Dr. W. Rosenhain and Mr. F. C. A. H. Lantsberry at the meeting of the Institution of Mechanical Engineers on Friday, January 21. Dr. Rosenhain explained that this report dealt with the properties of some alloys of copper, aluminium, and manganese, and is confined to some of the more interesting alloys likely to be of practical service. The greater part of the work was confined to alloys containing less than 11 per cent. of aluminium, and also less than 11 per cent. of manganese. It is impossible to state adequately and briefly the enormous amount of valuable information resulting from this research—the report occupies 174 pages of the institution's transactions. Specific mention might be made of the great tensile strength exhibited by one of the alloys in the form of a cold-drawn bar, having a yield point of 40.88 tons per square inch and an ultimate stress of 52.08 tons per square inch. This alloy had 9.99 per cent. aluminium, 2.01 per cent. manganese, and 88 per cent. copper. Another alloy shows hardness sufficient to enable it to take a cutting edge that will sharpen a lead pencil. In addition to the mechanical tests and microscopic and freezing-point investigations, corrosion in sea water has been examined. Further and more searching tests on the latter are now proceeding at Portsmouth Harbour, and have also been arranged for in the warmer sea water at Malta Dockyard.

THE January number of the *Journal of the Royal Statistical Society* begins a new series of the journal, to be issued monthly during the session. It is hoped that the greater rapidity of publication thus secured will be of service, as papers read one month will now be in the hands of fellows, and the public generally, by the middle of the following month instead of sometimes not appearing for three months or more, as is necessarily the case with a quarterly journal. Current notes also form a new section of the journal which it is hoped will increase its general interest.

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OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN FEBRUARY:—

- Feb. 4. 5h. Venus in perihelion.
 6. 12h. Mercury stationary.
 7. 12h. 25m. Uranus in conjunction with the Moon (Uranus 3° 19' N.).
 9. 12h. 36m. Venus in conjunction with the Moon (Venus 13° 34' N.).
 12. oh. Venus in inferior conjunction with the Sun.
 13. 13h. 22m. Saturn in conjunction with the Moon (Saturn 1° 18' N.).
 15. 6h. 12m. Mars in conjunction with the Moon (Mars 3° 1' N.).
 19. 17h. Mercury at greatest elongation west of the Sun.
 19. 21h. 33m. Neptune in conjunction with the Moon (Neptune 4° 10' S.).
 26. 3h. Venus at greatest heliocentric latitude north.
 „ 17h. 34m. Jupiter in conjunction with the Moon (Jupiter 2° 29' S.).

MARS.—Readers of these columns should be fairly well acquainted with Prof. Lowell's views concerning the Martian features and their significance, but they will find interesting the comprehensive summary given by Prof. Lowell in No. 13 of *Scientia*, the international science review published at Bologna, and obtainable from Messrs. Williams and Norgate. Therein the author reviews the observations of the melting snow-caps, of the "canals" and oases, which, by virtue of their dependent vegetation, undergo striking changes in conformity with the Martian seasons, and the theoretical considerations which have led him to conclude that Mars is habitable by organisms not essentially different from those with which we are acquainted. That Mars has no water except that contained in its atmosphere and that which forms the snow-caps, Prof. Lowell avers, but he contends that that water is artificially "engineered" in such a way that organic existence is rendered possible.

CAROLINE HERSCHEL AND HER COMET SEEKER.—At the present moment, with the subject of comets so much to the fore, an article which appears in the January number of *Himmel und Erde* is of especial interest. The writer gives many details of Caroline Herschel's strenuous life and describes her labours with the comet seeker. A facsimile reproduction of a letter, dated August 5, 1831, from her to Director Hausmann, tells how the comet seeker was made and how she wished it to be used after she had finished with it. The instrument was made of odds and ends by her brother "between breakfast and dinner." "The tube had once been used as a Newtonian finder to the 20-foot reflector. The circular board once served for a fly-wheel in some experiment; and for the pole, I was sent to the scullery to find a mopstick. The rest was sawed and chopped in the shapes as they were wanted—as for plaining we could do without, there was no time for niceties." Yet, she adds, it stood for forty-seven years without wanting a single repair, travelling all over the house and garden, at Slough, many a night; and with it she discovered five of the eight comets credited to her name.

EDDY FORMATION IN THE WAKE OF PROJECTING OBSTACLES.

CONSIDER a stream bounded by and moving parallel to the plane OX, with velocity U, and containing a stationary vortex at A (a, b), or, what is the same thing, an unbounded fluid containing a stationary vortex-pair at A, B (Fig. 1). With the notation $w = \phi + i\psi$, $z = x + iy$, ϕ = velocity potential, ψ = stream function, the potential function is given, for this case, by

$$w = U \left(z + 2ib \log \frac{z - a - ib}{z - a + ib} \right).$$

Inside a certain surface OQP, the stream lines are closed curves and the motion is cyclic; outside, the fluid streams past the surface as if it were a solid obstacle, as is well